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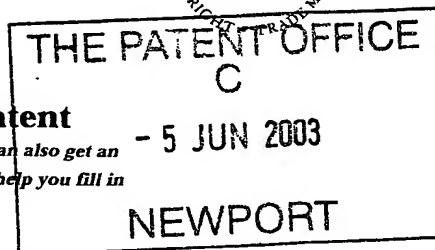
William Morell

Dated 11 July 2006

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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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1. Your reference

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2. Patent application number

(The Patent Office will fill in this part)

0312899.8

05JUN03 E812625-1 D10002
P01/7700 0.00-0312899.8

3. Full name, address and postcode of the or of each applicant (underline all surnames)

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Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

8645921001

4. Title of the invention

Downhole Tool

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Kennedys Patent Agency Limited
Floor 5, Queens House
29 St Vincent Place
GLASGOW
G1 2DT

Patents ADP number (if you know it)

08058240002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

YES

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body. See note (d))

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description 14

Claim(s)

Abstract

Drawing(s) 4

44 RM

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature

KENNEDYS

Date

04.06.03

12. Name and daytime telephone number of person to contact in the United Kingdom

Arlene Campbell TEL 0141 226 6826

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1 Downhole Tool

2

3 The present invention relates to centralisers used to
4 centre tools in a tubular or well bore downhole. More
5 specifically, the invention relates to an expandable
6 centraliser which can centre a tool in an opening larger
7 in diameter than a diameter through which the centraliser
8 can freely pass.

9

10 When drilling or working on wellbores for use, for
11 example, in oil and gas exploration, it is desirable to
12 be able to increase the diameter of the well bore at a
13 location within the well. This is typically done below a
14 section of casing and thus a tool capable of being passed
15 through the casing, which has a first diameter, and

1 expanding to cut or mill out a bore having a diameter
2 greater than the first diameter must be used. Such tools
3 are referred to as underreamers.

4

5 Underreaming tools commonly comprise one or more pairs of
6 cutting blades which are moveable from a retracted
7 position to an extended position. The tool is maintained
8 in the retracted position so that it may pass through the
9 casing, it is then moved to the extended position and
10 held there by fluid pressure created in the drill string.

11 A disadvantage of these tools is that the two blade
12 arrangement provides 4 point contact on the walls of the
13 wellbore which does not centralise the tool when the
14 wellbore is inclined or horizontal.

15

16 Centralisers are known for centering tools in a wellbore.
17 The first type typically comprise a cylindrical body
18 sized to have a diameter approximately equal to the
19 diameter of the well bore at the location where the tool
20 needs to be centred. Unfortunately these centralisers
21 cannot pass through openings smaller than the diameter of
22 the well bore at the location where the tool needs to be
23 centred and therefore cannot be used to centre
24 underreamers.

25

1 A second class of centralisers comprise a cylindrical
2 body having longitudinally arranged spring bows
3 circumferentially around the body. These centralisers can
4 pass through openings as small as the diameter of the
5 body and then expand, by virtue of the bows, to
6 centralise themselves and a drill string in well bores of
7 larger diameters. However, due to the weight of the drill
8 string, these centralisers tend to 'drop' to the low side
9 of an inclined or horizontal well and thus lose their
10 centering ability in these environments.

11

12 It is an object of the present invention to provide a
13 centraliser for centering a tool in an opening larger in
14 diameter than the diameter of an opening through which
15 the centraliser can freely pass.

16

17 It is a further object of the present invention to
18 provide a centraliser which can centre a tool on a drill
19 string in well bores of any inclination.

20

21 It is a yet further object of the present invention to
22 provide an expandable centraliser which can centralise a
23 tool through a well bore of varying diameter.

24

1 According to a first aspect of the present invention
2 there is provided an expandable centraliser for centering
3 a tool in a well bore having an opening larger in
4 diameter than the diameter of an opening through which
5 the centraliser can freely pass, the centraliser
6 comprising a body connectable in a workstring, said body
7 having a bore running axially therethrough, said body
8 including a first portion being substantially cylindrical
9 with a substantially circular cross-section of a first
10 diameter and a second portion being polyhedral in cross-
11 section to provide a plurality of faces parallel to said
12 bore; a plurality of centralising members, each
13 centralising member being located on a said face; and
14 actuating means, said actuating means, on actuation,
15 moving said centralising members from a first position
16 within the first diameter to a second position wherein
17 portions of said members are located outside the first
18 diameter.

19

20 Preferably the second position is variable depending on
21 the actuation means and is preferably the diameter of the
22 larger opening.

23

24 Thus the centraliser is expandable so that the
25 centralising members can remain within the first diameter

1 for the centraliser to pass through a small opening and
2 can then be extended to contact a bore of a larger
3 diameter and hence centralise the tool.

4

5 Though the centraliser can operate with two centralising
6 members it is more preferably that there are three or
7 more centralising members. More preferably there are an
8 odd number of centralising members. Advantageously there
9 are three centralising members. This provides a simple
10 mechanical design.

11

12 Preferably the faces are identical and arranged
13 equidistantly around the body. Advantageously there are
14 three faces, providing a triangular cross-section, with a
15 centralising member arranged on each face.

16

17 Preferably each centralising member is pivoted against a
18 face. Thus on actuation, each member swings across the
19 face and extends from it. Preferably also a spring is
20 located at each pivot such that each member is returned
21 to the first position from the second position on removal
22 of the actuation.

23

24 Preferably the actuation means is a piston, the piston
25 having a leading end arranged to contact an operating

1 face of each centralising member, on actuation thereof.

2 Preferably the piston is hydraulically actuated. More

3 preferably the piston operates by differential fluid

4 pressure created in the work string.

5

6 The centraliser may include one or more intensifiers,

7 each intensifier comprises a first face perpendicular to

8 the bore having a surface area greater than an operating

9 surface area of the piston. Each intensifier may abut a

10 first face of a neighbouring intensifier to provide a

11 cascade. Preferably one intensifier is arranged to abut

12 the operating surface area of the piston. In this way the

13 centraliser can be operated in a work string having a low

14 fluid pressure at the centraliser as would occur if the

15 centraliser is located below a motor on the work string.

16

17 Preferably the second portion is arranged on a

18 cylindrical core of the body. In this way the first and

19 second portions can rotate independently of each other.

20 Thus in use, the first portion may rotate with the work

21 string while the centralising members remain stationary

22 in the wellbore.

23

1 An embodiment of the present invention will now be
2 described, by way of example only, with reference to the
3 following drawings of which:

4

5 Figure 1 is a cross-sectional view through an expandable
6 centraliser according to the present invention;

7

8 Figure 2 is an exploded view of the expandable
9 centraliser of Figure 1;

10

11 Figures 3(a) and (b) are part cross-sectional views
12 through the expandable centraliser of Figure 1 with the
13 centralising members in the (a) first and (b) second
14 positions; and

15

16 Figures 4(a) and (b) are views of the expandable
17 centraliser of Figure 1 in the (a) first and (b) second
18 positions.

19

20 Referring initially to Figure 1, there is illustrated an
21 expandable centraliser generally indicated by reference
22 number 10 in accordance with an embodiment of the present
23 invention. Centraliser 10 comprises a body 12 having a
24 first portion 14 which is substantially cylindrical and
25 defines the diameter of the centraliser 10. A further

1 portion 16 comprises a sleeve 18 mounted over a narrow
2 cylindrical portion 20. Mounted below the second portion
3 16 is a third portion 22 which is also substantially
4 cylindrical. At an upper end 24 of the centraliser 10
5 there is located a connector 26 for connecting the
6 centraliser 10 into a drill string (not shown). At a
7 lower end 28 of the centraliser 10, there is located a
8 threaded portion 30 for connecting the centraliser 10 to
9 a lower portion of a drill string (not shown). It will
10 be appreciated that the connectors 26, 28 can be used to
11 connect the centraliser 10 to a tool within a drill
12 string which requires to be centralised in the well bore.

13

14 The remaining components of the centraliser 10 are best
15 seen when Figure 1 is viewed in conjunction with Figure
16 2. Figure 2 illustrates an exploded view of the
17 centraliser 10 of Figure 1, like parts have been given
18 the same reference number to aid clarity. Centraliser 10
19 has an axial bore 32 passing through a centre axis from
20 the upper end 24 to the lower end 28 of the centraliser
21 10. Arranged from the lower end 28 there is located the
22 connector 30 and above this rests a sub 34 located around
23 the cylinder 20. Allen set screws 32 connect the sub 34
24 to the cylinder 20 so that they can rotate together.
25 Above the sub 34 is located a nylon spacer 38 protecting

1 thrust ball bearings 40. The bearings provide for
2 rotation of the sleeve 18 on the sub 34. Sleeve 18 has
3 an inner cylindrical surface 42. The inner surface 42
4 provides a smooth sliding relationship with the narrow
5 cylinder 20.

6
7 The outer surface 44 of the sleeve 18 comprises a
8 substantially triangular arrangement of three surfaces 46
9 a, b, c providing an equilateral triangle on the outer
10 surface 44 of the sleeve 18. Each face 46 a, b, c
11 includes a pivot 48 on which a centralising member 50 a,
12 b, c is located. A spring 52 located on the pivot 48 to
13 bias the members 50 to a longitudinal position where they
14 rest upon each face 46.

15
16 Each centralising member 50 comprises a paddle having an
17 aperture 54 for connection to the pivot 48, a rounded
18 edge 56 and an upper actuating edge 58. Edge 58
19 comprises two portions, a short planar portion 60 and a
20 sloping portion 62. The members 50 can be made of any
21 suitable material although they are preferably made of
22 stainless steel. Further they may be of any shape which
23 allows them, once arranged in a longitudinal position on
24 the face 46, to reside within the diameter of the upper
25 portion 14. The upper edge 58 of each member 50 rests

1 above the face 46 so that they can be acted upon by a
2 actuating surface 64.

3

4 The actuating surface 64 is a lower face of the upper
5 portion 14. Face 64 is arranged on a further nylon
6 spacer 66 with equivalent thrust ball bearings 68. The
7 face 64 can rotate independently of the sleeve 18 and
8 members 50. Above the spacer 66 is arranged a cam 70
9 which is acted upon by three cam pins 72 a, b, c. In the
10 embodiments shown, the cam pins 72 are attached to the
11 cam 70 for ease of operation. The cam pins 72 are
12 protected by an outer sleeve 74 arranged around the upper
13 portion 14 of the centraliser 10.

14

15 In the inner bore 32 above the cam pins 72 is located a
16 piston 76. Piston 76 includes two pairs of seals, 78, 80
17 to prevent fluid within the bore 32 leaking to other
18 portions of the centraliser on the outer surface 82 of
19 the piston 76. Piston 76 acts as an intensifier by
20 having a narrow portion 84 and a broader portion 86. In
21 this way an upper surface 88 is provided on the broader
22 portion 86 with a large surface area on which fluid
23 within the bore can act to operate the piston 76. It
24 will be appreciated that further pistons of this design
25 could be mounted above the piston 76, each with

1 decreasing narrower portions 84 and substantially greater
2 surface areas 88 so that fluid pressure on the upper
3 surfaces 88 increases the effective pressure on each
4 piston in turn.

5
6 Reference is now made to Figures 3 and 4 of the drawings
7 which illustrate the centraliser 10 in a first position
8 and in a second position operating position. Like parts
9 to those of Figures 1 and 2 have been given the same
10 reference numeral to aid clarity. In use, sleeve 18 is
11 located on cylinder 20 and the members 50 located on the
12 pivots 48. Cam 70 rests between the sleeve 18 and the
13 body 12 with the cam pins 72 inside the body 12 resting
14 against the piston 76. Threaded connector 30 is
15 connected to a drill string and preferably to a tool, for
16 example an underreamer in the drill string. The upper
17 connector 26 is connected to the remaining drill string
18 which may include a motor.

19
20 When in the well bore a low pressure is maintained
21 through the bore 32 such that the piston 76 is not
22 actuated. The cam 70 rests against the upper portion 14.
23 In this position, each member 50 is arranged parallel
24 with the bore 32 and remains substantially on a
25 respective face 46. The upper surface 60 of the member

1 50 rests against the actuating surface 64 of the above
2 portion 14. In this position the centraliser can be run
3 through a well bore casing which has a diameter equal to
4 or greater than the diameter of the upper portion 14.

5
6 When the underreamer has reached a position for operation
7 within the well bore, the underreamer can be centralised
8 by increasing fluid pressure through the bore 32. An
9 increase in fluid pressure provides a pressure
10 differential across the surface 88 of the piston 76.
11 Piston 76 is then forced downwards with the cam pins 72
12 driving the cam 70 in a downward direction such that the
13 actuating surface 64 contacts the surface 58 of each
14 member 50. As the actuating surface 64 is moving towards
15 the lower end 28 of the centraliser 10, the surface 58
16 will run on the surface 64 such that the contact with the
17 surface 58 will move from the small portion 60 to the
18 larger surface 62 of the member 50. As this movement
19 occurs the member 50 is forced to swing on the pivot 48
20 so that it moves cross the face 46 and extends from the
21 sleeve 18. A stop 90 limits the radial extension of each
22 member 50 by abutting to the surface 64. All members 50
23 a, b, c will move simultaneously as the piston 76 moves.
24 It will be appreciated that the outer edge 94 of each
25 member 50 will also limit the radial extent of the

1 centraliser as it abuts an inner surface of a casing or
2 well bore. In this way the centraliser 10 can be used in
3 a well bore casing of a variable diameter as each member
4 50 can dynamically move in response to pressure applied
5 at the surface 94. The pressure upon piston 76 ensures
6 that the members 50 are always in their most radially
7 extended position as required.

8
9 When work is finished in the well bore, pressure within
10 the bore 32 is dropped and as a result the piston 76 is
11 relaxed. The springs 52 move the members 50 back to
12 their longitudinal positions on each of the faces 46 of
13 the sleeve 18. The centraliser 10 can then be retracted
14 with the underreamer back through a small diameter
15 opening.

16
17 The principle advantage of the present invention is that
18 it provides a centraliser for centring a tool in an
19 opening larger diameter than the diameter of an opening
20 through which the centraliser can pass freely.

21
22 A further advantage of the present invention is that it
23 provides a centraliser which can centre a tool on a drill
24 string in wells of any inclination. This is because the
25 pressure applied on each of the surfaces 94 of the

1 members 50 is uniform and the members 50 are therefore
2 not inclined to drop to a lower side of the well bore.

3

4 It is a yet further advantage of the present invention in
5 providing a centraliser which can centralise a tool in
6 varying diameters of a well bore.

7

8 Various modifications may be made to the invention here
9 in described without departing from the scope thereof.

10 For instance though only three member 50 are shown on the
11 embodiment described it will be appreciated that any odd
12 number of members 50 may be used. Additionally, the only
13 single piston 76 is shown, identical pistons having
14 greater surface areas 88 can be sat up the piston 76 to
15 provide one or more intensifiers.

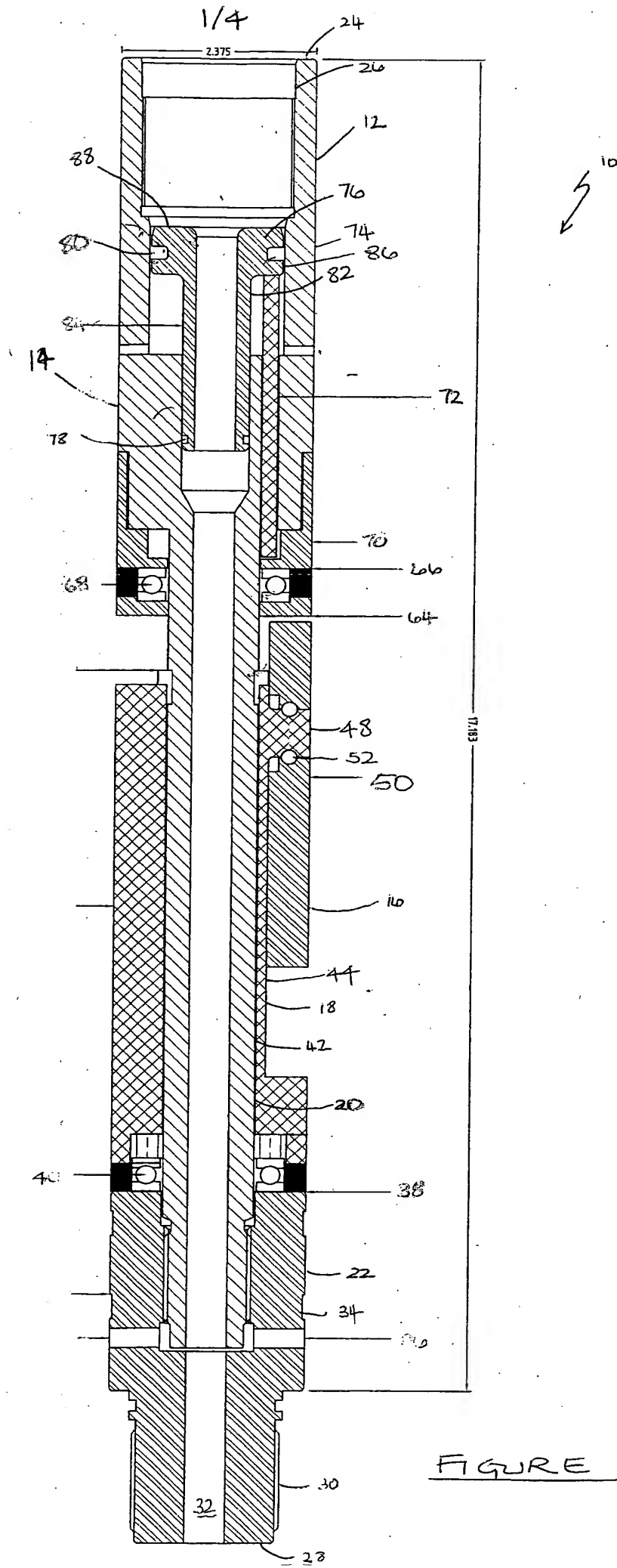
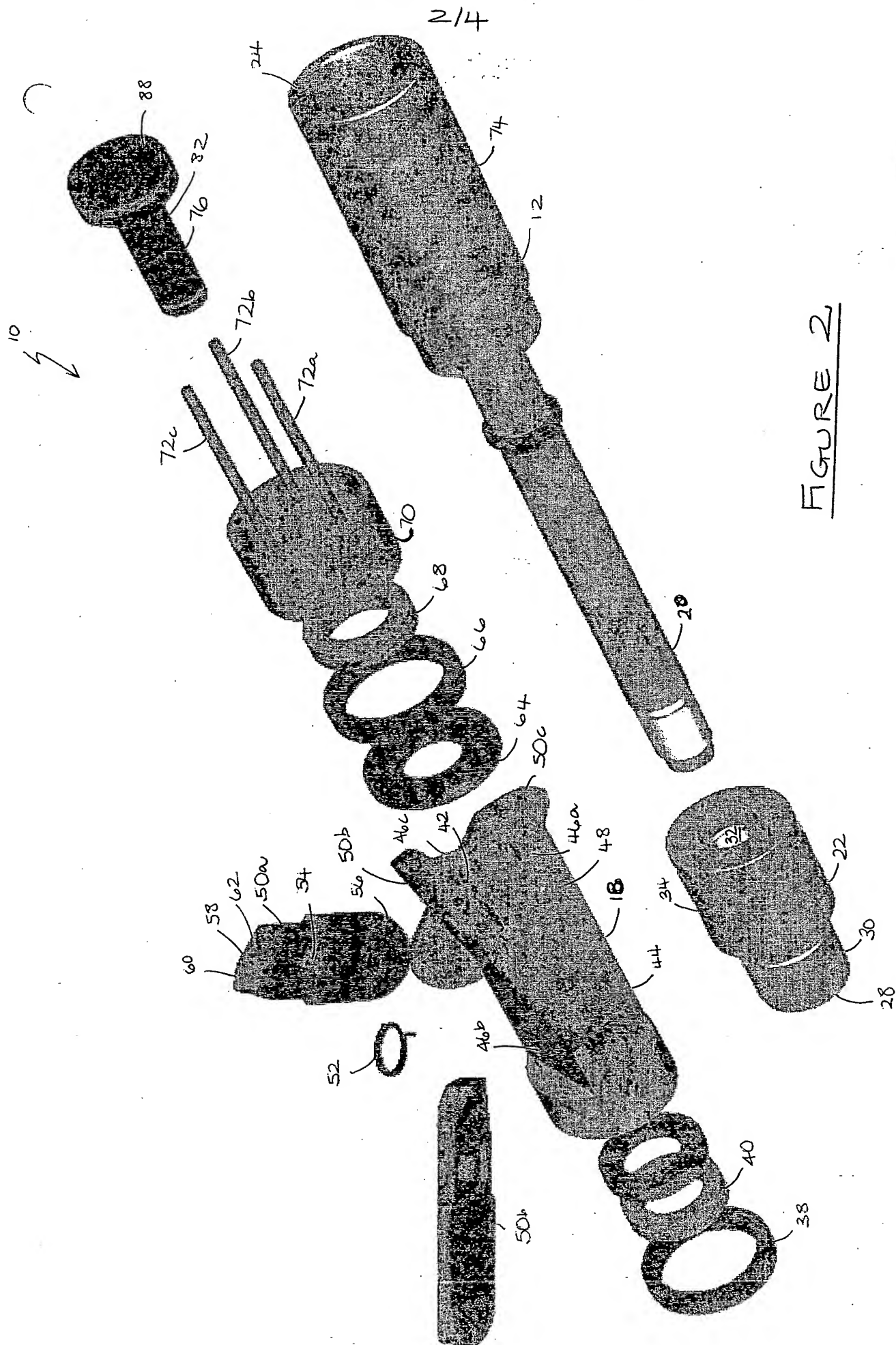


FIGURE 1

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FIGURE 2



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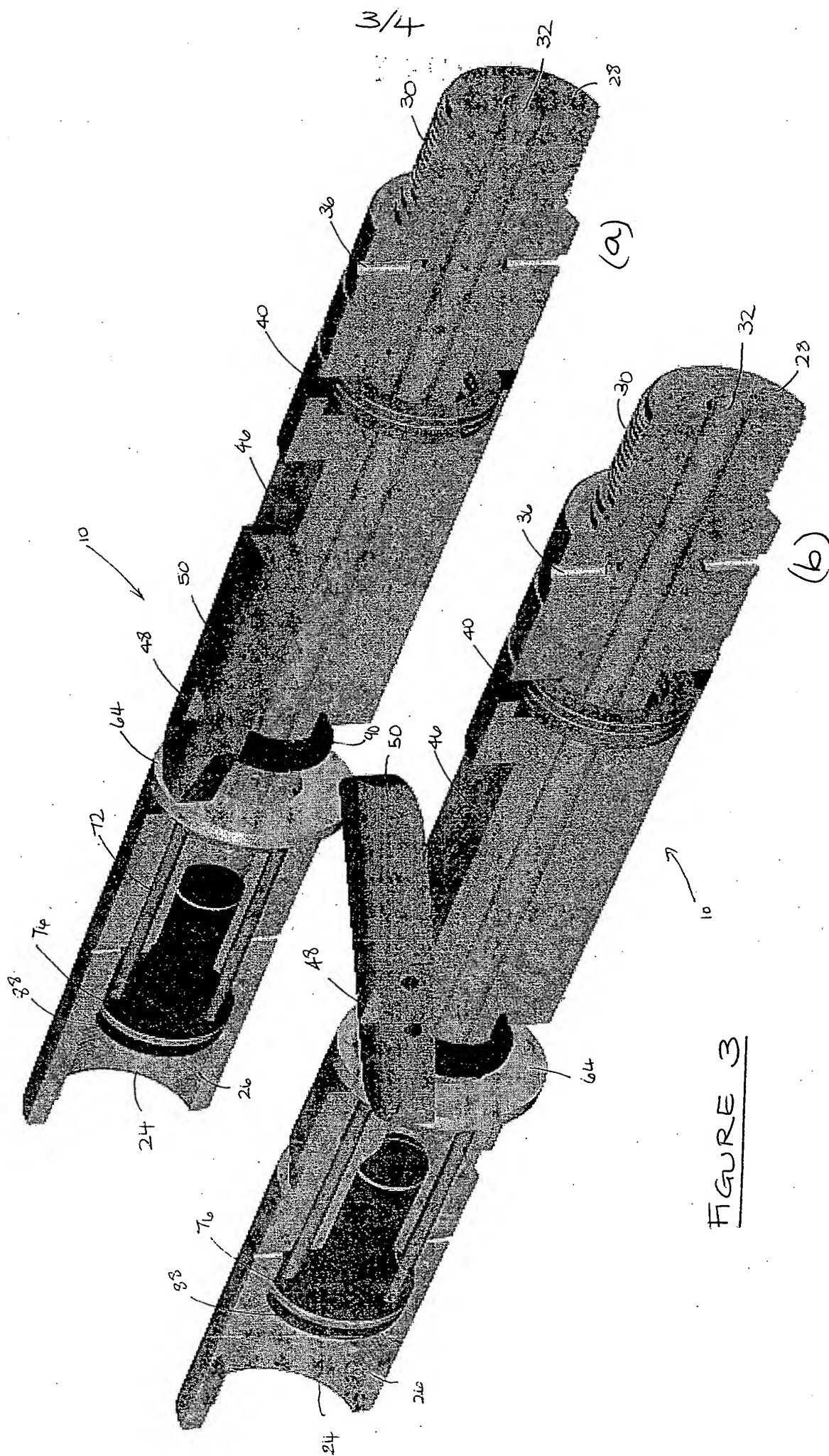


FIGURE 3)

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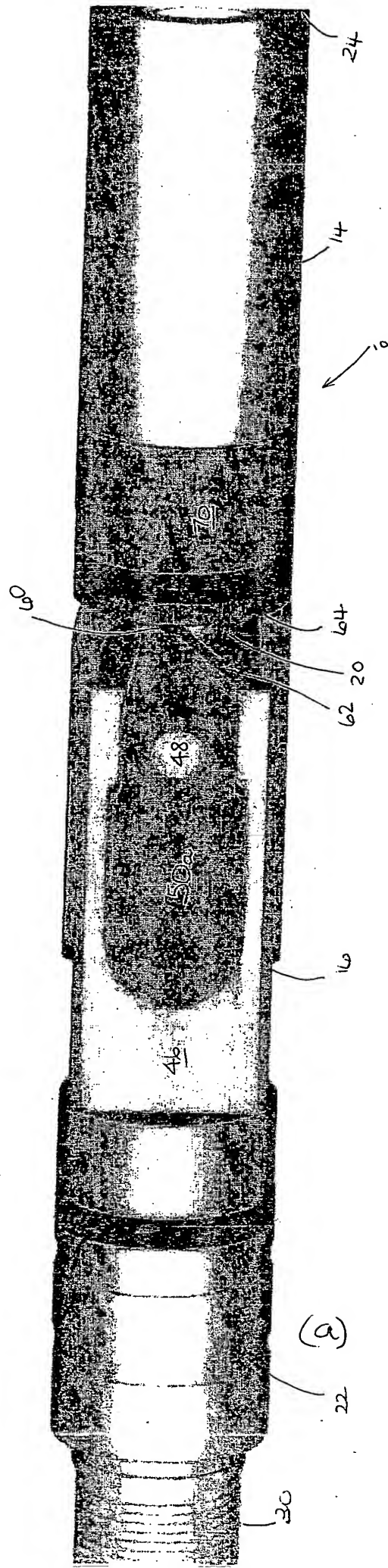
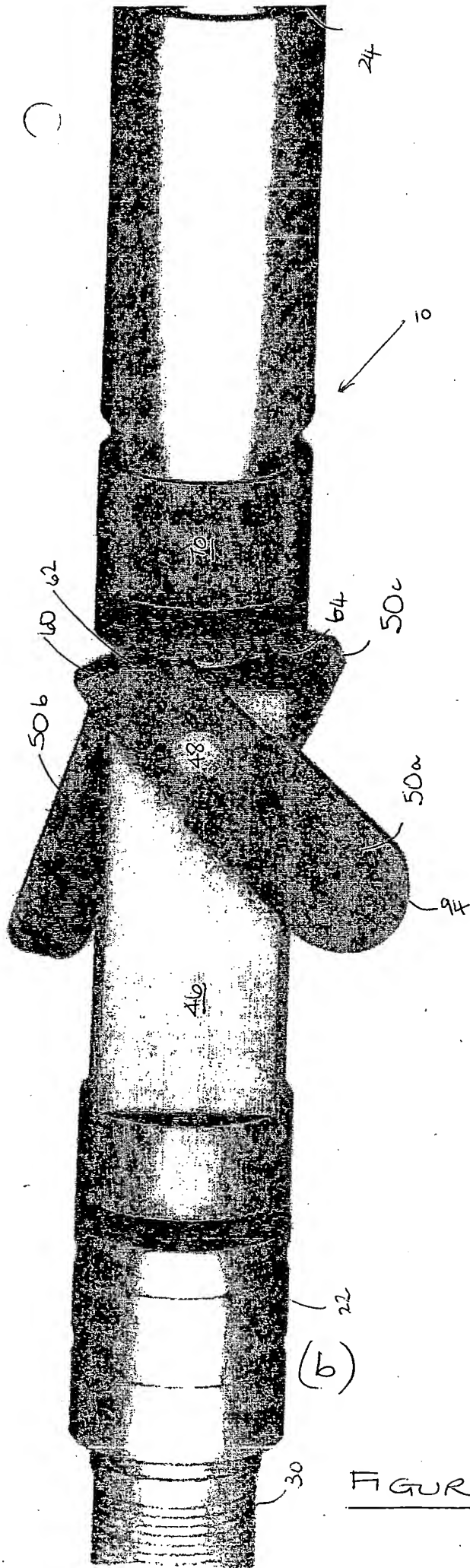


FIGURE 4

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